Global Trade Analysis Project
https://www.gtap.agecon.purdue.edu/

This paper is from the
GTAP Annual Conference on Global Economic Analysis
https://www.gtap.agecon.purdue.edu/events/conferences/default.asp

Impact of Russia's WTO Accession on the Structure of the Russian Economy*

Vitaly Kharitonov**

Purdue University, Center for Global Trade Analysis

Terrie Louise Walmsley***

Purdue University, Center for Global Trade Analysis

Abstract

In this paper we use a global computable general equilibrium model to examine the economic effects of Russia's accession to the World Trade Organization (WTO) on the Russian economy. We employ the comparative static GTAP model and the version 5.4 Data Base, modified to take account of increasing returns to scale in several vital sectors; including oil and gas extraction, ferrous and non ferrous metals industries, and motor vehicles.

We examine the impact of both complete elimination of tariffs and compare this with the more modest tariff reductions currently being proposed by Russia. The liberalization of services is also expected to be an important factor in Russia's negotiations. We therefore also examine the impact of services liberalization in communication and business and financial services sectors. The results indicate that in the short run changes in Russia's aggregate welfare are quite small -- however there are considerable structural implications resulting from trade and services liberalization. Expansions are expected in investment, the services sectors, motor vehicles and construction, while output of Russia's traditional export commodities declines. These implications are found to be sensitive to the extent to which trade is liberalized and whether entry/exit is allowed in those industries which are subject to increasing returns to scale.

May 2004

Draft: Do not quote without explicit written permission of the authors.

* The authors are grateful to Sergey Kieslev, Roman Romashkin and the OECD for their assistance wit this project.

** Corresponding author: Vitaly Kharitonov, Center for Global Trade Analysis, Department of Economics - Purdue University, West Lafayette IN 47907, USA; (765) 496-2243; vkharito@mgmt.purdue.edu

*** Center for Global Trade Analysis, Department of Agricultural Economics - Purdue University, West Lafayette IN 47907, USA; (765) 494-5837.; twalmsle@purdue.edu.

1. Introduction

Russia applied for membership in the World Trade Organization (WTO) in 1993[1], but active negotiations and discussions started only after President Putin declared WTO accession as one of the primary goals of his presidency. Even though significant progress has been made in recent years, negotiations are still proceeding slowly. One of the reasons for the slow progress is the lack of certainty about the possible gains and losses from WTO accession.

Many Russian industrialists believe that WTO accession, which implies trade liberalization, will lead to increased competition from foreign goods suppliers and hence to a decline in the market share of domestic producers (Yudaeva, [2003], Zeldovich [2002], CEFIR [2001]). Their concerns are partially based on previous experience. Russia took its first steps towards trade liberalization in the early to mid 1990s as a part of the IMF stabilization program. Unfortunately this period coincided with a deep economic decline. Hence, a majority of the Russian public believes that trade liberalization was one of the major causes of the decline, even though the decline was more likely due to other aspects of the transition period, such as structural changes in the economy, price liberalization, etc.

Another reason for the public's concern over the impact of Russia's accession is related to Russia's specific trade pattern. Zeldovich [2002] argues that most of Russia's exporters have little or nothing to gain from a WTO accession, since Russia's main exports – gas, oil, and aluminum – have few imported intermediate inputs which could gain from the elimination of tariffs and hence reduce the prices of exports, prices of these commodities are determined globally and tariffs on the importation of these commodities are relatively small.

Steel producers may face a decline in domestic demand due to the WTO accession agreement. This stems from the fact that the main domestic consumer of Russia's steel is the automotive industry, which is currently protected from foreign competition by high import tariffs. WTO accession may lead to a decline in tariffs and hence a decline in the motor vehicle sector, causing a decrease in domestic demand for steel. Yuri Chernikov, the head of research at Russia's largest steel plant, Severstal, states: "The resulting drop in demand on the part of the carmakers could outweigh all the potential benefits of [WTO] membership"[2].

The situation in Russia's service sector is even more complicated. Most of the service sectors, especially financial services, were not properly established until the late 1980s. Lobbying groups from these new sectors use the "infant industry" argument in support of their protection from foreign competition. As a result, there are a number of restrictions imposed on the type of operations foreign banks and insurance firms can conduct in Russia. For example, the right to attract personal deposits is only granted to banks with at least two years of operation on the Russian market. This condition is applied to both domestic and foreign banks. Moreover, even after two years of operation on the Russian market, foreign banks can still only accept personal deposit if they exceed

[1] Russia applied for membership in the General Agreement on Tariffs and Trade (GATT) in June 1993 and the GATT Working Party was transformed into the World Trade Organization (WTO) Working Party in 1995.

[2] Zeldovich [2002]

55,000 Euros. Foreign banks are also prohibited from operating on the Russian stock market (Gaydar [2003]).

Hence, most of the arguments against WTO accession refer to possibly negative sector level effects. Furthermore the arguments are based not on quantitative estimations, but rather on the wishes of existing producers or service providers to protect themselves from foreign competition.

In turn, supporters of accession argue that accession will provide benefits to Russian firms through improved access to the markets of WTO member countries, which can cover possible losses in domestic market shares that come from increased foreign competition. They also argue that despite some sectoral decline, the accession will lead to an improvement for the economy as whole. However, supporters' also rarely refer to quantitative estimates in support of their arguments. Obtaining estimates of the impact of Russia's accession to the WTO would therefore be crucial for advancing the various arguments over the benefits of accession.

One of the key issues in the Russia-WTO negotiations is energy price setting in Russia. The EU argues that domestic prices of energy in Russia are much lower than the world prices and that this is unfair competition which should be eliminated under the WTO accession agreement. In response, Russia's President Putin told a Russia-German summit meeting in the Urals, October 8, 2003: "We cannot move to world energy prices in a single day. It will ruin the country's economy. Eurobureaucrats either do not understand this or are trying to impose conditions which are unacceptable for Russia's entry to WTO". In reply Arancha Gonzalez, spokeswoman for European Trade Commissioner Pascal Lamy in Brussels, stated that: "We are not asking the Russians to make unreasonable concessions or to force obligations on the Russians other than those in the WTO". The problem is that the Russian government has a monopoly over the energy industries. According to the EU, the Russian government uses very high export taxes to support a domestic price of gas at a level below the market price, which it argues is inconsistent with WTO principles. Russia, on the other hand, argues that although Russia does impose export taxes on the Russian gas and oil industries, it does not use this to explicitly support the domestic markets. As a result, there is an issue whether this should be covered by the WTO at all. Hence in this paper we choose not to take into consideration potential effects of price reform in the energy sectors as part of Russia's accession.

There have been a few attempts to provide quantitative estimates in recent years. Jensen, Rutherford, and Tarr [2003] employed a CGE model to estimate the possible effects of Russia's WTO accession. To analyze the medium run effects they implemented 50% import tariff reduction and conducted two scenarios of liberalization of FDI in service sectors. Their results suggest that the overall gains from the accession are as much as 3.4% of GDP, most of which come from FDI reform. The sectoral effects are rather ambiguous: in some industries output increases (gas, oil, non-ferrous metallurgy, maritime and air transportation) regardless of the scenario assumed, several sectors (light and food industries, mechanical engineering & metal-working) decline in both cases, and for some sectors the effects can be positive or negative depending on whether full or partial reform of FDI is implemented. On the other hand, in the long run the WTO accession could lead to a welfare improvement of up to 12% of GDP, and output grows in most of the sectors. Other research conducted by Yudaeva [2002] concurs with Jensen,

Rutherford, and Tarr [2003] on the importance of services liberalization: according to Yudaeva [2002] services liberalization reform can provide gains of up to 2.5% of GDP even in the short run.

In this paper we use a global computable general equilibrium model to examine the economic effects of Russia's accession to the WTO on the Russian economy. We employ the comparative static GTAP model and the version 5.4 Data Base[3], modified to take account of increasing returns to scale in several vital sectors, such as oil and gas extraction, ferrous and non ferrous metals industries, and motor vehicles. Unlike Jensen, Rutherford, and Tarr [2003], we implement the current accession offer made by the Russian Federation during the negotiations. Version 5.4 of the GTAP data base is based on 1997 data, while the Jensen, Rutherford and Tarr [2003] analysis is based on 1995 data. We then compare this with the alternative of complete elimination of tariffs. The liberalization of services is also expected to be an important factor in Russia's negotiations. We therefore also examine the impact of services liberalization in communications, and business and finance services.

The remaining part of the paper is organized as follows. Section 2 provides a brief background summary of the Russian economy, including an analysis of Russia's trade pattern. Section 3 outlines the model, including the modifications made and data used to take account of increasing returns to scale. Section 4 outlines the experiments undertaken in this paper. In Section 5 we analyze the effects of both a decrease in the import tariffs to the negotiated level and full trade liberalization on welfare, GDP, production, and trade of Russia and its trading patterns. The paper is summarized and conclusions made in Section 6.

2. Background

Russia is the largest economy in the world that is not a member of the World Trade Organization. According to the GTAP Data Base Russia's GDP was $US458.5 billions in 1997, which is approximately 1.6% of world GDP. Russian GDP in real terms declined in 1998 by 4.9% as a result of the crisis in Russia's economy, however over the last 5 years it has grown at an average rate 5.4% per year. Analysis of the composition of GDP by sectors, represented in table 1, shows that the share of manufacturing and industry have declined over the last five years, while the share of services has increased.

The structure of Russia's output, represented in table 2, differs significantly from the world output structure. The share of non-government services is relatively small reflecting the fact that most of the services sectors were established only 15 years ago and are still developing. In turn, the share of resource extraction and agriculture in total output are much higher than in the rest of the world reflecting the fact that the economy is resource abundant.

Analysis of Russia's output disposition shows that about 90% of total output is consumed domestically and 10% is exported. However, a significant proportion (63%) of the output consumed domestically is used as intermediate inputs. The share of exports in

[3] The data used here was obtained from the GTAP Data Base (Dimaranan and McDougall [2002]). The data was aggregated according to the aggregation scheme presented in Appendix A. All data are measured in $ US 1997. This is the same data as is used in the modeling and analysis undertaken in the paper.

output varies significantly across sectors – there are several sectors which export more than 40% of output, while some sectors sell their output almost entirely to the domestic market. Table 3 shows the percentage of sales to the domestic and export markets for the non-services sectors and the tariff rates applied to imports. Not surprisingly import tariffs are highest in those sectors which produce primarily for the domestic market. Hence high tariff rates are used to provide domestically oriented sectors protection from foreign competition. Trade liberalization should therefore affect these sectors relatively more.

Over 60% of Russia's exports are provided by five sectors: natural gas, oil, ferrous metals, non-ferrous metals, and chemical products. Since each of these sectors exports more than 25% of its total output, it is useful to define these sectors as 'export oriented'. Similarly, we define 'final consumption goods' as those commodities where the share of final consumption (private and government consumption) in total production is higher than 20%. 'Intermediate goods' are likewise defined as commodities where the share of intermediate usage in total sales is greater than 80%. Classification of goods based on the above definitions is represented in Appendix B[4]. It is clear from the data in Appendix B that most of the 'Intermediate goods' are also those commodities for which Russia has very high exports – natural gas, oil, ferrous metals, non-ferrous metals, and chemical products.

The commodity import structure is relatively more diversified. In most cases, the share of each commodity's imports in total imports to Russia is less than 10%. The only exceptions are manufacturing goods (21% of total import), light industry products (13%), and other food products (10%). These commodities have large shares despite relatively high tariffs. Furthermore, about 70% of these imports are also defined as final consumption goods.

This pattern in Russia's comparative advantage – i.e., that Russia exports mostly intermediate goods while importing commodities for final consumption – could be a significant factor when examining the gains and losses to the Russian economy of its accession to the WTO.

Russia's trade pattern is also biased towards a few regions. About 85% of Russia's exports are sold to four markets: Western Europe (39%), Former Soviet Union (17%), China and Asia (15%) and Eastern Europe (13%). In turn, Russia's imports are dominated by Western Europe (48% of total import to Russia) with smaller proportions being obtained from China and Asia (14%), Former Soviet Union (12%), NAFTA (11%), Eastern Europe (8%) and other regions (7%). This means that the health of the Western European economies is very important for Russia's economic welfare. Although Russia has a trade agreement with the EU[5], the structure of Russia's exports and imports have evolved over time as the Soviet Union and then Russia exported gas and oil to Western Europe. In exchange Russia has received goods that have not been produced in Russia or have been significantly different in quality (e.g. electronics, motor vehicles, equipment).

[4] We also treat manufacturing commodity as a final consumption for the purpose of this analysis. This sector is highly aggregated and includes different types of goods, many of which can be used both as intermediate and final consumption goods (computers, electronics, etc.).

[5] Agreement on Partnership and Cooperation establishing a partnership between the European Communities and their Member States, of the one part, and the Russian Federation, of the other part. Signed at Corfu on 24 June 1994. http://europa.eu.int/comm/external_relations/russia/pca_legal/

This pattern has not altered significantly as Russia has opened up its economy to the rest of the world.

3. Model specification

We used a modified version of a multi-region applied general equilibrium model, GTAP v.6.2 (Hertel, [1997]). This modification allows for imperfect competition and scale economies and uses the approach suggested by Francois and Roland-Holst [1997], Francois [1998], and extended by Elbehri and Hertel [2003].

The GTAP Data Base (Dimaranan and McDougall [2002]) is used in conjunction with the modified model. The data was aggregated according to the aggregation scheme presented in Appendix B. In addition to the GTAP Data Base, some additional data was required for the imperfect competition components of the model. This additional data and its relationship to the modifications made to the model are also described in this section.

3.1 Imperfect competition

We assume an imperfectly competitive market structure for five sectors: natural gas, oil, ferrous metals, non-ferrous metals, and motor vehicles. These sectors are highly concentrated; as shown in Table 4 by the low number of firms and the existence of markups. Since at least the first four sectors produce relatively undifferentiated products, we have chosen to adopt an oligopolistic market structure[6].

Firms in the oligopolistic sectors are assumed to interact differently with domestic rivals, which produce a homogenous good, than with foreign rivals, which produce a differentiated good (in the sense of Armington). With respect to domestic rivals, including foreign-owned firms producing domestically, each oligopolist is assumed to hold a Cournot conjecture – namely that rivals' outputs remain unchanged when the firm varies its own output. With respect to foreign rival firms, supplying differentiated imports, each oligopolist holds a Bertrand conjecture – that is foreign rivals' prices are assumed to remain unchanged in response to a change in the own price[7]. Following Francois and Roland-Holst [1997], the elasticity of substitution among imports is also assumed to equal that between domestic and imported goods (non-nested CES preferences).

The oligoplolistic market structure used in this paper implies an increasing return to scale production function. These scale economies, in the existing modification of the GTAP model, are modeled by combining fixed costs with an average variable cost function that is independent of scale. That is, average variable costs (AVC) are constant as output increases and hence equal to marginal costs (MC). Average total costs therefore take the following form:

---

[6] An alternative approach to modeling imperfect competition could be the firm-level product differentiation approach of Dixit and Stiglitz (1977). However, the "love of variety" effect generating by this approach seems unrealistic for natural gas, oil, ferrous and non-ferrous metals sectors due to homogeneity of product produced.

[7] The approach adopted in this analysis is that proposed by Francois and Roland-Holst (1997). It differs from other formulations of Cournot behavior (e.g., Smith and Venables 1988; Willenbockel, 1994) in which firms are assumed to hold Cournot conjectures about both domestic and foreign rivals.

$$AC = \frac{FC}{x} + AVC = \frac{FC}{x} + MC \qquad (1)$$

where: *AC*, *AVC*, *MC*, *FC* and *x* are average cost, average variable cost, marginal cost (also invariant to scale), fixed cost, and output per firm, respectively. It is common in the literature (Francois, [1998]) to calibrate fixed costs via the cost disadvantage ratio (CDR), which measures the extent to which average total costs exceed marginal cost:

$$CDR = \frac{AC(x) - MC(x)}{AC(x)} = \frac{FC}{TC(x)} \qquad (2)$$

Since the CDR is treated as a parameter of the model, it is necessary to estimate the CDR for each sector from external sources. The procedure used in this paper to determine the CDR is outlined in Appendix A. The resulting CDR parameters are depicted in Table 4.

The CDR parameter is implemented into GTAP tablo code through variable SCALE, which is defined as $SCALE = \frac{CDR}{1 - CDR}$ and is initially read as a parameter[8]. Equation (3):

$$M_A = \frac{ne}{(1 + SCALE)(ne - 1)} \qquad (3)$$

then defines the power of the markup over average cost, relating it to the number of firms (n), the CDR[9], and the elasticity of demand (e), which is computed by equation (4).

$$e_i = s + (1 - s)\sum_r \frac{X_{ir}}{X_i} S_{ir} \qquad (4)$$

where s is elasticity of substitution, X_{ir} is demand by region *r* for goods of origin i, X_i is total demand faced by oligopolists in region i, S_{ir} is the market share of goods from region i in region *r* within the commodity group under consideration.

Since average cost is automatically computed in the GTAP model, as an experiment is implemented CDR adjusts and so does the elasticity of demand[10] causing markup over average cost to change if firms are not allowed entering/exiting the market. In the case when entry/exit is allowed, profitability within an oligopolistic sector is fixed, and number of firms adjusts to keep markup over average cost constant.

In turn the markup over average cost affects prices determined in the equilibrium through equation[11] (5):

$$\Delta P_s = \Delta P_m + \Delta TO - \Delta M_A \qquad (5)$$

Where: Δ is the change in, Ps is supply price, Pm is market price and TO is output tax.

---

[8] For more detail about implementation of imperfect competition based on CDR parameters into GTAP tablo code see Francois [1998].

[9] `AC_MARKUP(i,r) = (1/(1+SCALE(i,r)))/(1-(CV_RATIO(i,r)/DELAST(i,r)))` in GTAP tablo code notation.

[10] For more detail about elasticity of demand adjustment mechanism see Elbehri and Hertel [2003]

[11] `ps(i,r) = to(i,r) + pm(i,r) - p_AC_MARKUP(i,r)` in GTAP tablo code notation. Notice that positive change in output tax (to>0) is equivalent to output tax decrease.

In the imperfect competition extension to the model, the variable *ao* is used to incorporate falling average costs. The variable *ao* is output augmenting technical change. In the standard GTAP model increases in *ao* reduce the quantity of inputs (intermediate and factors) required to produce a given amount of output – this is equivalent to a fall in the average cost curve. Equation (6) determines the value of *ao* endogenously for the oligopolistic sectors.

$$\frac{1}{CDR} * (qva - firms) = ao \quad [12] \qquad (6)$$

where: *qva* is percentage change in real value-added demanded by the sector, *firms* is percentage change in the number of firms operating on the market, and *ao* is output augmenting technical change.

Equation (5) states that *ao* rises or average costs fall as the quantity of value added per firm (*qva – firms*) rises (or production increases and the firms moves down its average cost curve). The rate of this increase depends on the inverse of the CDR (the extent to which average total costs exceed marginal cost). In turn, the variable *ao* affects welfare:

$$TC = 0.01 * \sum_i VOA_i * ao_i \quad [13] \qquad (7)$$

4. The experiments

We analyze the comparative static effects of two scenarios. The first scenario considers the affect of a reduction in Russia's import tariffs to the level currently being negotiated (hereafter the WTO accession scenario). The second scenario implies complete import tariffs elimination in Russia (hereafter the full trade liberalization scenario).

Table 5 depicts the current GTAP 1997 import tariffs in Russia, actual (2003) tariffs[14], and the proposed import tariffs following the implementation of the WTO accession agreement. Using the Altertax facility in RunGTAP we first update Russia's import tariffs to equal the actual tariff rates in 2002[15]. All experiments are then based on the updated data.

Under the WTO accession scenario we reduce all import tariffs where the current rate in 2002 is above the rate proposed rate following WTO accession[16]. Under the complete trade liberalization scenario all import tariffs are reduced to zero.

The services sectors in Russia are also expected to be liberalized as a result of Russia's accession to the WTO. Yudaeva [2002] argues that services liberalization

[12] OSCALE(i,r)=[SCALE(i,r)] * [qva(i,r) - firms(i,r)] - ao(i,r) = 0 in GTAP tablo code notation, where OSCALE(i,r) is exogenous.

[13] CNTtech_aor(r)=[0.01*EVSCALFACT(r)]*[sum(i,PROD_COMM,VOA(i,r)*ao(i,r))] in GTAP tablo code notation.

[14] The current import tariffs level calculated by Sergey Kiselev and Roman Romashkin based on Russian Goskomstat and Russian Custom Committee data.

[15] The Altertax facility in RunGTAP allows intelligent Database adjustments, which reflect recent policy changes in one or several regions after 1997 (e.g. tariff rates changes, tax rates changes, etc.). See Malcolm [1998].

[16] Sectors, where the actual import tariffs are above the proposed, are highlighted in the table 5.

reform can provide gains of up to 2.5% of GDP. Many of Russia's services sectors are protected from foreign competition through legislative restrictions, even though there are no formal import tariffs. Services barriers in Russia can be used to restrict the cross-border supply of services, foreign direct investment (FDI) in the domestic market and/or entry of new domestic firms into the domestic market. Restrictions on the cross border supply of services are applied through the reduction of a tariff equivalent or technological shock which affects imports, while restrictions on FDI or domestic market access are implemented via an output tax equivalent or productivity shock which affects production. In this paper we concentrate on the removal of restrictions on FDI and domestic market access.

A further issue is whether the barriers are cost-escalating or rent-creating. If barriers are cost escalating they restrict entry through higher production costs and are implemented by shocking productivity ("ao" or "ams") for the corresponding sectors. On the other hand, if the barriers affect the ability of the sector to earn rents, then the shock should be implemented through a tax equivalent ("to" or "tms"). Dee [2004] argues that the barriers to the communication, and business and financial services sectors in Russia are rent-creating, and therefore should be represented as tax equivalents.

Dee [2004] estimated ad valorem tax equivalents of the barriers to the Russian financial sector and communication sector (Table 6). These estimates have two components: restrictions which apply to all firms (domestic and foreign) producing in the domestic market; and restrictions which apply to foreign firms only. Since foreign and domestic firms are not accounted for separately in the GTAP model, a weighted average of the estimated ad valorem equivalents is determined using the shares of foreign ownership in Russia's financial sector[17]. In all scenarios we implement the liberalization of the communication and financial sectors through a shock to the output tax[18].

Under each scenario we also undertake two experiments, one which allows firms to enter/exit the oligopolistic sectors while the other does not allow for the possibility of enter/exit by firms. In the standard model/closure, there is no entry/exit of firms (n is exogenous and equal to zero). Firms take advantage of the possibility to manipulate prices by changing the power of the markups over average costs (M_A in equation (3)) and hence their profitability. Hence without entry/exit a positive shock will lead to an increase in profitability and output. In the case of entry/exit, the share of profit in total revenue earned by firms operating in the markets is assumed to be fixed. Thus, the power of the markup over average costs (M_A in equation (3)) remains fixed and each firms output, but not prices, adjusts in response to the shocks. Firms enter/leave (i.e. n adjusts) until the markup (M_A in equation (3)) returns to its original level determined in the initial data base. A positive shock therefore results in more firms entering the sector and a rise in industry (but not necessarily firm) output.

[17] According to Bulletin of Banking Statistics, #4, 2004, (http://www.cbr.ru/eng/BBS/bank_bulletin.asp) share of foreign banks in Russia is approximately 0.5%.

[18] Moreover, since these barriers are not reflected in the original GTAP data, we use an altertax experiment to incorporate these barriers into the initial data base, and then eliminate them under both the WTO accession and full trade liberalization scenarios.

5. Quantitative Effects of Russia's WTO accession

5.1. Overall effects.

The aggregate welfare effects of the WTO accession and full trade liberalization experiments are reported in Table 7. In all cases Russia gains additional welfare as a result of the liberalization of trade restrictions however, the size of the improvement is relatively small and varies across experiments. Welfare varies from $US585 millions (0.1% of Russia's GDP) under the WTO accession entry/exit scenario to $US1,862 million (0.4% of Russia's GDP) under the full trade liberalization entry/exit scenario. Since the liberalization of the communication, and business and financial services sectors is implemented under both scenarios, the relative effects of the services barriers in services are stronger when the import tariff reductions are smaller (WTO accession). In the WTO accession scenario approximately 60% of welfare improvement is due to services liberalization, while under the trade liberalization scenario the services liberalization accounts for 15% of the welfare gain.

Russia's main trade partners (Western Europe, Former Soviet Union, Eastern Europe, Asia) also gain in terms of welfare as a result of Russia's accession under all of the scenarios examined, while countries with lower intensities to trade with Russia lose regardless of which scenario is assumed. The only region which gains under the full trade liberalization scenario but loses under the WTO accession scenario (though the loss is negligible – $20-40 millions) is NAFTA. This is due to the fact that while NAFTA plays a relatively important role in Russia's imports, it has a much smaller share of Russia's exports. Under the WTO accession scenario tariff reductions are concentrated in several sectors, which NAFTA does not export to Russia. Hence, the smaller reduction in Russia's import tariffs under the WTO accession eliminates the gains NAFTA would have made if trade has been liberalized completely. The structure of Russia's trade pattern with respect to other regions under consideration does not change under the WTO accession scenario.

Table 8 shows that investment, export, import, and GDP rise regardless of the scenario and entry/exit assumption however, changes in private consumption are ambiguous.

Russia's real GDP increases by only 0.2% as a result of Russia's accession to the WTO. This gain could be as large as 1.1% if Russia chooses to reduce its tariffs across the board (full trade liberalization scenario). The gains to Real GDP from liberalization of services are minimal – only 0.1% of Real GDP.

Even though the rise in real GDP is small, rates of return in Russia rise due to a rise in the rental price causing a large increase in real investment of 4%. In the long-run this large increase in investment would have further positive effects on real GDP and welfare in Russia. In the short run, this increased investment is partially funded by foreigners, inducing foreign capital inflows, which result in a decline in Russia's trade surplus.

Imports rise both in quantity and in dollar terms. As import tariffs are eliminated imports become cheaper. Since elasticities of demand are greater than 1 in absolute value, a decrease in the price of imports relative to domestic goods leads to substitution towards imports. Russia's exports must also increase, but to a lesser extent due to the overall fall

in the trade balance. This drives down export prices and the terms of trade[19], since other regions do not reduce their tariffs on goods from Russia. The trade balance decreases by $3.6 billions under the accession scenario (or almost $7.6 billions in the case of full trade liberalization).

Finally, private consumption is essentially driven by income and the composite price of private consumption. In the no entry/exit case Russian income falls, however the price of private consumption falls further causing real private consumption to rise. Under the entry/exit assumption both income and the price increase, but the latter rises more, causing real private consumption to fall.

Table 9 decomposes the welfare effects into a number of components – the allocative efficiency, scale economies[20], terms of trade and the investment saving effects. The expansion of imports and exports affects the terms of trade and has a negative effect on welfare under both scenarios. The terms of trade effect is negative because export prices decrease substantially relative to imports. Under the WTO accession scenario import prices have a negligible effect on the terms of trade, while the effect of import prices is larger under the trade liberalization scenario it is still not sufficient to offset the large fall in export prices.

The negative terms of trade effects are dominated by welfare gains from resource reallocation (allocative efficiency). The main source of this welfare improvement is the increase in imports. The allocative efficiency term measures the extent to which resources are better allocated. An improvement in allocative efficiency arises when a country increase its imports of goods which have high tariffs or increase (reduce) production of goods which have high taxes (subsidies). In this case, Russia is increasing its imports of high tariff commodities and hence better allocating its resources. Furthermore Russia is re-allocating resources towards commodities which it exports (export tax and production effect in Table 9). Russia is also increasing production of services which were previously restricted, however this effect is relatively small (production effect).

The scale economies effect, which relates only to the imperfectly competitive sectors, also has a positive effect on Russia's welfare. Notice these effects are larger in cases where entry/exit of firms is allowed. These results are driven by equations (6) and (7). If firms are not allowed to enter/exit the market, the variable "*firms*" is exogenous and zero and hence output per firm rises/falls significantly more. Average costs (or ao) therefore fall/rise further causing the welfare effect to be larger in absolute terms. A decomposition of the technical change term based on equations (6) and (7) is provided in table 10.

With entry/exit the WTO accession scenario leads to firms exiting four of the five markets (all markets except the motor vehicles industry). Output per firm and hence average costs (ao) change by less in absolute terms. Welfare rises by more as a result, as the losses due to the decline in the four resources sectors are reduced. We provide more detailed analysis of changes in oligopolistic sectors in the following sub-sections.

[19] Lower prices of imported intermediate goods may also reduce prices of Russian exports, however this effect is expected to be minimal since Russia primarily exports intermediate goods and imports consumption goods.

[20] Related to imperfect competition.

5.2. Sectoral effects

Under the WTO accession scenario output declines in 19 out of 27 sectors (Table 11). These results are divided into two components, the proportion due to tariff reductions and the total due to tariff and services liberalization. The reduction in import tariffs has a positive effect on output in most of the sectors, particularly the export orientated sectors such as ferrous and non-ferrous metals where exports of these commodities increase relatively more. Exports of all commodities rise as a result of the reduction in tariffs (Table 12).

These positive effects from the liberalization of trade are offset by a decline in output caused by the service liberalization; this is the case in all sectors except construction and the sectors directly affected by the service liberalization shocks (communication, and business and financial sectors). Service liberalization also has a positive affect investment (capital goods sector output increases 4% in Table 11) due to the fact that the price of capital goods falls further and the rental prices rises due to the services liberalization. As a result the construction sector's output (a primary input into the capital goods sector) increases. Moreover the increased investment allows the current account surplus to fall. Since the liberalization of services does little to change imports (Table 13) exports are no longer required to increase as far to maintain the initial trade balance surplus and as a result exports change by less in absolute terms (Table 12). The terms of trade also declines by less as a result raising welfare.

Even though output declines in many sectors, only in two of them – manufacturing (-10%) and light industry (-3.5%) – does output decrease by more than 1%. Such small negatives do not continue in the long run because the large increase in investment provides additional capital which leads to an expansion of output.

The alternative scenario – full trade liberalization scenario – implies much more significant sectoral adjustments and partially supports the WTO accession antagonists' point of view that trade liberalization can cause significant structural adjustments leading to a deep decline in some sectors most notably in agriculture, food production, manufacturing, and light industry. Hence Russia's desire to negotiate all aspects of the WTO accession carefully is somewhat justified.

5.2.1. Export Oriented Sectors

Under the WTO accession scenario, output rises in all the export oriented sectors (Table 11) as a result of the reduction of trade barriers under WTO accession, however overall output falls with services liberalization. Generally exports rise for these commodities, particularly as a result of the liberalization of trade. The direction of changes in imports (Table 13) varies across sectors.

Domestic production of gas and oil decline due to a decrease in domestic intermediate demand for these commodities, for example 82% of gas sold on the domestic market is purchased by the electricity sector. As output of electricity falls, demand for gas also decreases. A similar situation occurs in the oil sector, where 98% of domestic sales are to the chemical product sector, where production also falls. Notice that imports of gas and oil decrease, however such changes have only a very small effect on total output of these sectors, since the shares of imports in domestic sales of gas and oil respectively are negligible. While exports of gas and oil increase they are not sufficient to offset the decline in domestic intermediate demand, particularly after the service liberalization shocks have been taken into account.

Since four of the export oriented sectors are assumed to be oligopolistic, it is important to analyze the influence of the oligopolistic market structure on these sectors. Under the no entry/exit assumption markups over average costs and hence profitability declines in all four sectors: as imports become cheaper average costs decrease causing CDR and hence SCALE to increase, which leads to decrease in markup over average costs by equation (3). Under the entry/exit assumption however, the number of firms declines in all four of the export oriented sectors to keep the markups over average costs constant. This implies an increase in monopolistic power of the remaining firms and output per firm increases relative to the no entry/exit case as firms leave (table 10).

The direction of changes in imports (Table 13) varies across sectors. For most of these commodities imports and initial tariff rates are small and hence the impact on imports is minimal. The exception is chemical products where the increase in imports is large in comparison to the other sectors. Although the initial tariff rates are relatively low (9.5%) compared to other commodities these tariffs are reduced to 6% as a result of the accession agreement. This is the largest percentage reduction in tariffs agreed upon under the accession agreement.

5.2.2. Intermediate goods

Under the WTO accession scenario, output of the construction and other minerals sectors increases, while sectoral output of trade, electricity and other utilities declines. Growth in construction is caused by the investment expansion: 90% of this sector's production is consumed by the capital goods sector. It induces an increase in the other minerals sector since 35% of the latter sectors production is used in construction. Imports of construction and capital goods also rise for the same reason – increased demand for the production of investment goods.

The decline in the trade sector is due to a decrease in production in the oil and gas industries, which consume 25% of trade services sold in the domestic market. A similar situation occurs in the electricity sector which is primarily (25%) consumed by both the metallurgy and manufacturing sectors. The decrease in output of these sectors leads to a fall in electricity production.

5.2.3 Final Consumption Goods

Since the motor vehicles industry is the only sector among other final consumption goods and services producers where oligopolistic market structure is assumed, we consider this sector first. Output of the motor vehicles sector increases under the WTO accession scenario, as well as both exports and imports. The rise in imports is due to the decline in tariffs on foreign motor vehicles. The domestic motor vehicles sector also gains as a result of lower tariffs on its intermediate inputs, namely ferrous metals (14% of the cost of motor vehicles) and motor vehicle parts[21] (12%). Under the no entry/exit assumption firms within sector increase their markup over average costs. Sector expansion under the entry/exit assumption is therefore driven by both an increase in number of firms: reacting to the ability to earn profit; and the reduced price of intermediates.

The liberalization of services was implemented in two services sectors - communication, and business and financial services. In both cases output increased. Imports of these commodities fell by 8% and 5% respectively, while exports increased by 10% and 14%. These increases are the direct result of the liberalization of these sectors.

[21] Motor vehicle parts are included in motor vehicles in the GTAP aggregation

This liberalization involved reducing the barriers to entry for domestic and foreign firms. As a result, the liberalization of the sectors resulted in a shift from importing these services towards increased production in the Russian market[22].

Outputs in all other final consumption sectors decrease; except the manufacturing sector where output falls significantly. This is caused by import expansion: import tariffs in this sector decrease from 11.7% to 8.4%, a considerable decline second only to chemical products. This decline in tariffs induces an increase in imports of 11.4%. As a result, domestic demand on manufacturing goods shifts towards imports and the domestic manufacturing sector declines significantly.

6. Conclusion

The results obtained suggest that the Russian economy is likely to improve in terms of welfare and GDP under either the WTO accession or the full trade liberalization scenario. The WTO accession scenario based on Russia's current offer and services liberalization implies smaller structural changes in the economy. The services sectors expand as a result of the liberalization of services, however output decreases slightly in many of the other sectors. The liberalization of services also causes a large increase in investment which adds to the capital stocks in the long run; hence these decreases in output do not continue into the long run.

On the other hand the full trade liberalization scenario leads to significant structural shifts in the economy and rather supports the accession antagonists' point of view that the WTO accession can lead to a deep decline in some sectors. Hence Russia's desire to negotiate all aspects of the WTO accession carefully is somewhat justified.

[22] Prior to liberalization of the business and financial, and communication markets foreign firms preferred to use services provided by firms located outside of Russia (i.e. import services). After the accession these foreign service providers can establish commercial presence, hence imports decline.

References

CEFIR, 2001 *"Russia in the WTO: Myths and Reality"*, Center for Economic and Financial Research (CEFIR), Moscow, http://www.cefir.org/papers_policy.html

Dee, P., 2004 *"Services trade liberalisation in Russia and the Baltic States"* Asia Pacific School of Economics and Government, Australian National University, 2004

Dimaranan, B. and McDougall, R. (eds.), 2002, *"Global Trade, Assistance, and Protection: The GTAP 5 Database"*, West Lafayette, Indiana (Center for Global Trade Analysis, Purdue University)

Elbehri, A., Hertel, T., 2003 *"A Comparative Analysis of the EU-Morocco FTA vs. Multilateral Liberalization"*,

Francois, J. F., 1998 *"Scale economies and imperfect competition in the GTAP Model"* GTAP Technical Paper No. 14, www.gtap.org

Francois, J. F. and D. W. Roland-Holst, 1997 *"Scale economies and imperfect competition"*. In: Francois, J. and K. Reinert (eds.) "Applied Methods for Trade Policy Analysis: A Handbook", New York, Cambridge University Press

Gaydar, Y. (ed.), 2003 *"The Economics of Russian Transition"*, Chapter 14, MIT Press; Russian version available at http://www.iet.ru/publics/1000/1000.html

Hertel, T.W. (ed.), 1997 *"Global Trade Analysis Modeling and Applications"*, Cambridge University Press

Jensen, J., Rutherford, T. and Tarr, D., 2003 *"Economy-Wide and Sector Effects of Russia's Accession to the WTO"*, The World Bank.

Yudaeva K., 2002 "Final report of the Regional and sectoral analysis of Russia's accession to WTO grant project administered by the Moscow Public Science Foundation", CEFIR, http://www.cefir.org/papers_policy.html

Yudaeva, K., 2003 *"Russia's WTO Accession: Current state of Negotiations and Forecasts of the Effects"*, CEFIR, Moscow, http://www.cefir.org/conf24-25.html

Zeldovich, M., 2002 *"Going Nowhere Slowly: Russia's Accession to the WTO Is Not Being Supported by the Main Exporters"* The Russia Journal Weekly, September 20, 2002, www.dbtrade.com/publications/going_nowhere_slowly.pdf

Table 1

Russian Federation: Composition of GDP by Sector, 1995 - 2002 1/

	1995	1996	1997	1998	1999	2000	2001	2002
	(In percent of GDP)							
Agriculture 2/	7.2	7.3	6.5	5.7	7.7	6.7	6.8	6.1
Industry	29.0	29.5	28.3	29.9	30.8	31.4	28.1	26.5
Construction	8.5	8.4	7.9	7.1	6.1	6.6	7.5	7.3
Wholesale, retail, foreign trade, public catering, procurement	19.6	18.3	17.6	19.5	23.2	23.7	22.5	22.8
Transportantion and communications 3/	11.9	12.4	12.1	10.9	9.7	9.1	9.4	10.0
Finance, credit, insurance, real estate operations, science and research, housing, geology, subsoil resources, exploration, meteorology, computer service, others	9.5	8.6	9.6	9.2	11.2	11.7	13.9	14.5
State administration and defense	4.7	4.6	5.5	5.9	4.4	4.3	4.6	4.5
Education, culture and art, health care, physical education and social security, utilities, non-production activities services to households, people's associations	9.6	10.9	12.5	11.8	6.9	6.7	6.8	8.1

Source: Russian Federation: Statistical Appendix, May 2003. IMF Country Report # 03/145, http://www.imf.org/external/pubs/cat/longres.cfm?sk=16575.0

1/ GDP share of gross value added by economic sectors, in basic prices -- excludes taxes, includes subsidies; not adjusted for imputed financial services.

2/ Agriculture, including companies servicing agriculture and forestry.

3/ Transport, communications, road and infrastructure.

Table 2

Structure of Output

	Russia	Rest of the World	*Sectors Included*
Agricultural Sector	9%	3%	*grow, agp, aga, frfs,*
Resource Extraction	12%	3%	*gas, oil, omn*
Food Products	6%	5%	*meat, dp, ofp*
Metallurgy	4%	4%	*fmet, nfm*
Manufacturing Sector	14%	24%	*cem, mnf, mvh, lin*
Utilities	7%	2%	*ely, uty*
Transportation Services	7%	5%	*otr, atp, wtp*
Construction	8%	7%	*cns*
Non-Government Services	13%	27%	*trd, bfs, cmm*
Government Services	16%	15%	*osg*
Dwellings	3%	3%	*dwe*

Source: GTAP database

Table 3

Russia's Output disposition and current import tariffs

	Domestic sales	Export sales	Import tariffs (%%)
Nonferrous Metals	32%	68%	9.6
Natural Gas	58%	42%	5.0
Oil	59%	41%	5.0
Ferrous Metals and Metal Products	63%	37%	7.4
Chemical Products	73%	27%	9.5
Manufactures	82%	18%	11.7
Light Industry Products	84%	16%	15.1
Forestry-Fishing	84%	16%	8.5
Other Minerals	92%	8%	5.0
Other Food Products	94%	6%	17.9
Motor Vehicles	98%	2%	18.4
Dairy Products	98%	2%	14.9
Agriculture, Plant Products	98%	2%	10.6
Wheat and Cereals	99%	1%	5.0
Agriculture, Animal Products	99%	1%	10.4
Meat Products	100%	0%	17.1

Source: GTAP database; import tariffs provided by Sergey Kiselev and Roman Romashkin

Table 4

Concentration in Oligopolistic sectors and CDR Parameters

	Number of Firms	Marginal Cost Markup	Accepted CDR
Gas	1	1.527	0.192
Oil	5	1.053	0.020
Ferrous Metals	12	1.022	0.020
Non-Ferrous Metals	12	1.013	0.020
Motor vehicles	3	1.250	0.162

Source: Authors' calculations. Data for number of firms that cover more than 80% of each sector's output and sectors' profitability provided by Sergey Kiselev and Roman Romashkin.

Table 5

Import tariffs in Russia

	GTAP Database Rate	Actual Rate	Proposed the WTO Accession Rate
Wheat and Cereals	5.0	5.0	16.5
Agriculture, plant products	6.7	10.6	10.4
Agriculture, animal products	7.4	10.4	12.9
Forestry-Fishing	9.3	8.5	6.6
Natural gas	5.0	5.0	5.0
Oil	4.8	5.0	5.0
Meat	16.5	17.1	26.3
Dairy Products	15.0	14.9	18.3
Other Food Products	11.4	17.9	17.2
Light industry products	17.0	15.1	13.3
Chemical products	9.3	9.5	6.0
Ferrous Metals and metal products	14.4	7.4	7.2
Nonferrous Metals	6.1	9.6	9.2
Other minerals	11.0	5.0	5.0
Motor Vehicles	21.4	18.4	17.2
Manufactures	9.7	11.7	8.4
Electricity	1.6	5.0	5.0
Other Utilities	0.0	0.0	0.0
Construction	0.0	0.0	0.0
Trade	0.0	0.0	0.0
Other Transport	0.0	0.0	0.0
Air Transport	0.0	0.0	0.0
Water Transport	0.0	0.0	0.0
Communications	0.0	0.0	0.0
Business and financial services	0.0	0.0	0.0
Public Administration, Defense, Education, Health, Recreational and other services	0.0	0.0	0.0
Dwellings	0.0	0.0	0.0

Source: GTAP database; data provided by Sergey Kiselev and Roman Romashkin

Table 6

Ad valorem tariff equivalents of non-tariff barriers in Russia's communication, and busines and financial services sectors

	Initial estimation	Weight	Average ad valorem equivalent
Telecommunication			
Fixed Lines	5.2	0.8	4.72
Mobile Lines	2.8	0.2	
Financial services			
Market access	6.18	1	6.23
National Treatment*	1.09	0.05	

*National treatment barriers are applied to foreign firms only

Source: Dee [2004]

Table 7

Aggregate Welfare Effects of Russia's Trade Liberalization and the WTO Accession by Regions,
$ US millions

	The WTO accession **no** entry exit		The WTO accession entry exit		Trade liberalization **no** entry exit		Trade liberalization entry exit	
	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*
Russia	681.9	*258.1*	585.2	*242.0*	1861.5	*1540.9*	1818.1	*1568.5*
Former Soviet Union	105.1	*94.6*	108.9	*97.2*	843.1	*831.8*	843.4	*830.4*
Eastern Europe	160.9	*152.6*	166.5	*155.9*	990.2	*977.0*	1015.3	*1000.1*
Western Europe	287.3	*354.7*	324.0	*370.3*	1622.0	*1683.8*	1777.4	*1817.9*
NAFTA	-40.6	*0.0*	-19.8	*7.1*	129.7	*168.5*	225.3	*250.1*
China	26.1	*28.3*	27.8	*29.4*	198.7	*201.6*	211.3	*213.6*
Asia & Australia	59.0	*118.8*	90.9	*127.0*	325.1	*382.3*	457.4	*489.9*
South America	-55.9	*-40.6*	-53.8	*-40.6*	-171.0	*-155.3*	-157.3	*-143.8*
Africa	-51.7	*-74.6*	-61.2	*-76.2*	-263.2	*-280.9*	-281.8	*-291.6*
Rest of the World	-178.0	*-169.6*	-186.8	*-172.2*	-518.2	*-504.8*	-528.2	*-509.1*

Source: Authors' calculations

Table 8

Macroeconomics Effects of Trade Liberalization on Russia, Volume Change*

	The WTO accession **no** entry exit		The WTO accession entry exit		Trade liberalization **no** entry exit		Trade liberalization entry exit	
	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*
Private Consumption	0.3%	*0.1%*	-0.2%	*0.0%*	0.9%	*0.7%*	-0.3%	*0.0%*
Investments	4.0%	*0.8%*	3.9%	*0.8%*	7.7%	*4.6%*	6.7%	*3.7%*
Government Consumption	-0.1%	*0.0%*	1.0%	*0.2%*	-0.8%	*-0.6%*	1.9%	*1.1%*
Export	1.0%	*2.4%*	1.2%	*2.4%*	17.9%	*19.3%*	19.1%	*20.3%*
Import	5.4%	*3.4%*	4.9%	*3.3%*	26.6%	*24.7%*	25.3%	*23.8%*
GDP	0.2%	*0.1%*	0.2%	*0.1%*	1.1%	*1.0%*	1.1%	*1.0%*

* Volume changes:
- Private Consumption: per capita utility from private household expenditure (up)
- Government Consumption: per capita utility from government expenditure (ug)
- Investments: output of capital goods sector (qcgds)
- Export: volume of merchandise export (qxwreg)
- Export: volume of merchandise imp orts (qiwreg)
- GDP: quantity of GDP (qgdp)

Source: Authors' calculations

Table 9

Static Welfare Effects of Trade Liberalization on Russia ($ US 1997 millions)

	The WTO accession **no** entry exit	The WTO accession entry exit	Trade liberalization **no** entry exit	Trade liberalization entry exit
Total Welfare	681.9	585.2	1861.5	1818.1
Allocative Efficiency	979.0	920.0	4676.7	4506.0
Production tax	*26.2*	*26.1*	*692.0*	*687.1*
Input tax	*226.6*	*217.0*	*868.5*	*808.8*
Consumption tax	*114.0*	*106.3*	*461.3*	*406.9*
Export tax	*49.7*	*58.7*	*627.0*	*652.6*
Import tax	*562.5*	*511.9*	*2027.8*	*1950.5*
Scale Economies	39.1	53.2	158.9	435.7
Terms of Trade	-352.3	-415.4	-3719.8	-3924.9
Investment-Savings Term	16.0	27.4	745.6	801.3

Source: Authors' calculations

Table 10

Decomposition of Scale Economies Effects Under the Russia's WTO Accession Scenario

	WYO accession, no entry/exit				**WYO accession, entry/exit**					
	qva	# of firms change (%%)	ao	Scale Economies Effect	qva	# of firms change (%%)	ao	Scale Economies Effect	VOA	1/CDR
Gas	-0.28	0	-0.067	-20.6	-0.34	-0.26	-0.020	-6.0	30626	0.24
Oil	-0.38	0	-0.008	-2.1	-0.36	-1.10	0.015	4.1	27559	0.02
Ferrous Metals	-0.92	0	-0.009	-2.0	-0.70	-0.27	-0.004	-0.9	22163	0.01
Non-ferrous Metals	-0.61	0	-0.012	-1.7	-0.15	-0.28	0.003	0.4	13991	0.02
Motor Vehicles	1.21	0	0.236	66.1	1.06	0.02	0.201	56.2	28042	0.19
Total Effect				**39.1**				**53.2**		

Source: Authors' calculations

Table 11

Sectoral Effects of Trade Liberalization and the WTO Accessionon Russia: Quantity of Output
%% Changes

	The WTO accession **no** entry exit		The WTO accession entry exit		Trade liberalization **no** entry exit		Trade liberalization entry exit	
	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*
Export Oriented Sectors								
Nonferrous Metals	**-0.6**	***2.6***	**-0.1**	***2.8***	**20.0**	***23.2***	**23.0**	***25.9***
Natural Gas	**-0.4**	***0.2***	**-0.4**	***0.2***	**1.5**	***2.1***	**1.7**	***2.2***
Oil	**-0.4**	***0.1***	**-0.3**	***0.1***	**1.4**	***1.8***	**1.5**	***1.9***
Ferrous Metals and Metal Products	**-0.9**	***1.5***	**-0.7**	***1.6***	**10.6**	***13.1***	**11.2**	***13.5***
Chemical Products	-2.5	*-1.5*	-2.5	*-1.5*	-1.3	*-0.4*	-1.1	*-0.1*
Intermediate Goods								
Construction	3.4	*0.7*	3.3	*0.7*	6.8	*4.1*	5.9	*3.4*
Other Minerals	0.5	*0.9*	0.6	*0.9*	6.4	*6.8*	6.6	*6.9*
Trade	-0.3	*0.1*	-0.4	*0.1*	-0.1	*0.3*	-0.2	*0.2*
Electricity	-0.7	*0.2*	-0.7	*0.2*	2.5	*3.5*	2.9	*3.8*
Other Utilities	-0.4	*0.1*	-0.5	*0.1*	1.8	*2.4*	1.7	*2.4*
Final Consumption Goods								
Motor Vehicles	**1.5**	***0.5***	**1.3**	***0.5***	**-0.3**	***-1.1***	**-3.4**	***-4.1***
Manufactures	-10.1	*-6.7*	-9.8	*-6.7*	-13.8	*-10.4*	-12.5	*-9.3*
Public Administration, Defense, Education, Health, Recreational and other services	-0.2	*0.1*	0.0	*0.1*	-0.4	*-0.1*	0.3	*0.4*
Meat Products	-0.3	*1.2*	-0.2	*1.2*	-24.7	*-23.3*	-24.1	*-22.7*
Dairy Products	-0.3	*0.8*	-0.3	*0.8*	-11.7	*-10.6*	-11.2	*-10.2*
Agriculture, Animal Products	-0.2	*0.3*	-0.2	*0.3*	-5.0	*-4.6*	-5.1	*-4.6*
Other Food Products	-0.8	*-0.1*	-0.9	*-0.2*	-15.5	*-14.9*	-15.4	*-14.7*
Communications	2.6	*0.1*	2.4	*0.0*	3.3	*0.8*	2.9	*0.5*
Wheat and Cereals	-0.9	*-0.2*	-0.9	*-0.2*	-4.0	*-3.3*	-3.9	*-3.2*
Agriculture, Plant Products	-0.4	*0.2*	-0.4	*0.2*	-5.1	*-4.6*	-5.1	*-4.5*
Forestry-Fishing	-0.6	*0.1*	-0.7	*0.0*	-1.0	*-0.3*	-0.9	*-0.2*
Light Industry Products	-3.5	*-1.1*	-3.4	*-1.1*	-9.0	*-6.6*	-8.2	*-5.9*
Business and Financial Services	3.5	*0.3*	3.5	*0.3*	4.9	*1.6*	5.0	*1.7*
Dwellings	-0.2	*0.0*	-0.7	*-0.1*	-0.2	*0.1*	-1.2	*-0.5*
Transportation								
Air Transport	0.5	*0.4*	0.3	*0.4*	3.2	*3.1*	2.8	*2.9*
Other Transport	0.1	*0.2*	-0.1	*0.2*	1.5	*1.7*	1.2	*1.5*
Water Transport	0.3	*0.5*	0.3	*0.5*	3.6	*3.8*	3.8	*3.9*
Capital goods	4.0	*0.8*	3.9	*0.8*	7.7	*4.6*	6.7	*3.7*

Source: Authors' calculations

Table 12

Sectoral Effects of Trade Liberalization and the WTO Accessionon Russia: Quantity of Export %% Changes

	The WTO accession **no** entry exit		The WTO accession entry exit		Trade liberalization **no** entry exit		Trade liberalization entry exit	
	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*	Overall effect	*Due to tariff elimination*
Export Oriented Sectors								
Nonferrous Metals	**-0.1**	***4.0***	**0.5**	***4.2***	**36.3**	***40.5***	**40.4**	***44.2***
Natural Gas	**0.0**	***0.3***	**0.1**	***0.3***	**1.6**	***1.8***	**1.8**	***1.9***
Oil	**2.6**	***2.3***	**2.6**	***2.3***	**7.7**	***7.4***	**7.7**	***7.4***
Ferrous Metals and Metal Products	**-1.4**	***3.2***	**-0.9**	***3.3***	**25.3**	***30.0***	**27.7**	***32.1***
Chemical Products	1.3	*3.0*	1.5	*3.0*	15.7	*17.3*	16.6	*18.0*
Intermediate Goods								
Construction	-0.8	*1.2*	-0.6	*1.2*	8.1	*10.1*	8.9	*10.7*
Other Minerals	-1.4	*2.2*	-1.1	*2.2*	16.1	*19.8*	17.7	*21.1*
Trade	1.0	*1.2*	1.2	*1.2*	10.4	*10.5*	11.1	*11.0*
Electricity	0.0	*1.0*	0.1	*1.0*	6.4	*7.3*	6.9	*7.6*
Other Utilities	-1.7	*1.5*	-1.5	*1.5*	9.2	*12.4*	10.3	*13.2*
Final Consumption Goods								
Motor Vehicles	**1.7**	***4.7***	**2.0**	***4.7***	**55.7**	***59.1***	**42.7**	***45.6***
Manufactures	-0.3	*6.2*	0.3	*6.2*	49.7	*56.9*	53.4	*60.2*
Public Administration, Defense, Education, Health, Recreational and other services	-0.7	*1.2*	-0.5	*1.2*	8.6	*10.4*	9.2	*10.9*
Meat Products	-0.8	*4.3*	0.1	*4.4*	76.3	*82.5*	81.2	*86.5*
Dairy Products	-0.5	*3.9*	0.2	*4.0*	57.3	*62.3*	61.0	*65.3*
Agriculture, Animal Products	0.2	*2.2*	0.7	*2.3*	41.6	*43.8*	43.4	*45.1*
Other Food Products	0.2	*2.1*	0.6	*2.2*	30.4	*32.4*	32.0	*33.6*
Communications	10.5	*1.1*	10.6	*1.1*	19.9	*10.1*	20.7	*10.7*
Wheat and Cereals	0.1	*2.4*	0.8	*2.5*	54.0	*56.6*	55.9	*57.9*
Agriculture, Plant Products	-0.4	*2.3*	0.4	*2.4*	63.8	*67.0*	66.9	*69.3*
Forestry-Fishing	0.6	*1.6*	1.1	*1.7*	17.4	*18.4*	18.6	*19.1*
Light Industry Products	-0.4	*4.2*	0.1	*4.2*	37.3	*42.1*	39.9	*44.3*
Business and Financial Services	14.0	*1.1*	14.2	*1.1*	22.8	*9.3*	23.5	*9.8*
Dwellings	-0.2	*0.0*	-0.3	*0.0*	-0.3	*0.0*	-0.3	*0.1*
Transportation								
Air Transport	1.1	*1.1*	1.3	*1.1*	9.3	*9.2*	10.0	*9.7*
Other Transport (Railroad)	-0.4	*1.0*	-0.3	*1.0*	7.5	*8.9*	8.1	*9.4*
Water Transport	0.5	*0.9*	0.7	*0.9*	7.5	*7.8*	8.0	*8.2*

Source: Authors' calculations

Table 13

Sectoral Effects of Trade Liberalization and the WTO Accessionon Russia: Quantity of Import %% Changes

	The WTO accession **no** entry exit		The WTO accession entry exit		Trade liberalization **no** entry exit		Trade liberalization entry exit	
	Overall effect	*Due to tariff elimination*	Overall effect	Due to tariff elimination	Overall effect	Due to tariff elimination	Overall effect	Due to tariff elimination
Export Oriented Sectors								
Nonferrous Metals	**1.3**	***0.6***	**1.2**	**0.5**	**83.4**	**82.9**	**81.9**	**81.5**
Natural Gas	**-0.7**	***-0.3***	**-0.9**	**-0.3**	**55.2**	**55.8**	**55.1**	**56.0**
Oil	**-4.5**	***-3.4***	**-4.5**	**-3.4**	**34.8**	**36.1**	**35.0**	**36.3**
Ferrous Metals and Metal Products	**1.2**	***-2.2***	**0.8**	**-2.3**	**1.3**	**-1.8**	**-0.9**	**-3.7**
Chemical Products	14.1	*13.0*	13.8	12.9	32.9	31.8	31.6	30.9
Intermediate Goods								
Construction	4.7	*-0.4*	4.4	-0.4	-0.4	-5.2	-1.9	-6.5
Other Minerals	2.1	*-1.9*	1.7	-1.9	-1.8	-5.6	-3.6	-7.0
Trade	-0.8	*-1.2*	-1.3	-1.2	-9.1	-9.3	-10.4	-10.2
Electricity	-0.6	*-0.8*	-0.8	-0.8	2.0	1.9	1.9	2.0
Other Utilities	1.5	*-1.4*	1.2	-1.4	-8.5	-11.1	-9.5	-11.8
Final Consumption Goods								
Motor Vehicles	**5.0**	***0.7***	**4.4**	**0.7**	**42.7**	**38.0**	**51.6**	**47.4**
Manufactures	15.7	*11.4*	15.2	11.4	37.1	33.1	34.9	31.3
Public A dministration, Defense, Education, Health, Recreational and other services	0.6	*-1.1*	-0.2	-1.3	-7.8	-9.3	-9.7	-10.5
Meat Products	0.4	*-3.2*	-0.4	-3.3	67.7	64.0	64.7	61.7
Dairy Products	0.4	*-3.2*	-0.3	-3.2	49.3	45.6	46.4	43.4
Agriculture, Animal Products	-1.4	*-2.4*	-2.0	-2.5	11.2	10.5	10.2	9.9
Other Food Products	2.4	*0.9*	1.8	0.9	63.8	62.4	61.7	60.8
Communications	-7.7	*-1.0*	-8.1	-1.1	-14.8	-8.3	-15.9	-9.1
Wheat and Cereals	-0.9	*-2.4*	-1.5	-2.5	-24.7	-25.9	-25.4	-26.3
Agriculture, Plant Products	0.6	*-1.3*	-0.3	-1.4	25.8	23.9	23.5	22.4
Forestry-Fishing	4.9	*4.1*	4.2	4.0	3.7	3.1	2.2	2.2
Light Industry Products	5.3	*2.8*	4.6	2.7	27.9	25.5	25.6	23.9
Business and Financial Services	-5.3	*-0.4*	-5.4	-0.4	-8.7	-3.7	-8.8	-3.9
Dwellings	-0.2	*0.0*	-0.3	0.0	-0.3	0.0	-0.3	0.1
Transportation								
Air Transport	-0.6	*-0.9*	-1.3	-1.0	-7.4	-7.6	-9.0	-8.6
Other Transport (Railroad)	0.5	*-0.9*	-0.1	-1.0	-6.4	-7.7	-7.9	-8.6
Water Transport	-0.3	*-0.7*	-0.9	-0.8	-5.9	-6.3	-7.3	-7.2

Source: Authors' calculations

Appendix A: Calibration of the CDR

Calibration of the Cournot markups is based on the following relationship:

$$\frac{P - MC}{P} = (1 - M^{-1}) = \frac{1}{ne} \qquad \text{(A1)}$$

where P = price, MC = (constant) marginal cost, $M = P/MC$ = the power of the markup over marginal cost, e = the perceived market demand elasticity, and n is the number of firms operating in the market.

Following Elbehri and Hertel [2003] the perceived market demand elasticity is

$$e_i = -\hat{X}_i / \hat{P}_i = s + (1-s)\sum_r \frac{X_{i,r}}{X_i} S_{i,r} \qquad \text{(A2)}$$

which can be found using data currently available in the GTAP data base.

Thus, the only additional information necessary to calculate the power of markup over marginal costs for a specific sector is the Cournot equivalent number of firms operating in this sector.

The markup over average costs can be obtained from the following expression:

$$M_A = \frac{P}{AC} = \frac{P*Q}{AC*Q} = \frac{REVENUE}{TOTAL\ COSTS} = \frac{PROFIT + TOTAL COSTS}{TOTAL\ COSTS} = 1 + \frac{PROFIT}{TOTAL\ COSTS} \qquad \text{(A3)}$$

The Russian statistical agency (Goskomstat) publishes data on the profitability of products (Profitability of products = Profit / Costs). Using this data for the oligopolistic sectors we obtain the power of markup over average costs.

The following relationship relates the CDR to markups over marginal and average costs:

$$M_A = \frac{P}{AC} = (1 - CDR)M \qquad => \qquad CDR = 1 - \frac{M_A}{M} \qquad \text{(A4)}$$

The CDR's are then obtained from the markups over average and marginal costs. The resulting CDR's are shown in Table A1. In several sectors the CDR was found to be negative. Under the stated formulation for the CDR (A4), a negative value for this parameter means that the markup over average costs is greater than the markup over marginal costs, which is inconsistent with the assumed cost structure. We suggest the following explanation of this paradox.

In many cases to optimize tax payments Russian producers sell their product to affiliated firms, registered in Russia's off-shore zones. The price reflected in the contract is exactly equal to the cost of production (i.e. the producer has zero profit). In turn, the affiliated firms sell the product to consumers (domestic or foreign) using real market price. If these firms are classified within the same sector as the original producer (which is possible), they have very small costs (paperwork, etc.), but profit relative to costs are huge. Thus, since we calculate elasticity of demand for the oligopolistic sector using concentration (number of firms) based on production, not sales by sector, but use overall sector profitability indicator, it can be the case that the obtained negative CDR parameters are driven by these "extremely effective" firms, which do not produce much and hence are not included in number firms used to calculate markup over marginal costs.

Since the obtained negative CDR parameters are very close to zero, to avoid inconsistency we set these CDR equal to the CDR implemented for other regions.

Since we assume an oligopolistic market structure for the sectors as a whole, we need to define both the number of firms and CDR not only for Russian sectors, but for all regions. Unfortunately we do not have data on the concentration and profitability for all regions. However, since most of the regions we consider in the model are highly aggregated,

we assume market structures in these regions are close to a competitive market. Analysis shows that if we assume the number of firms greater than 100, the sector behaves as if it were competitive regardless of the CDR imposed. Similarly, we set the CDR parameter for all regions equal to 0.02, i.e. close to zero.

Table A1

Calculation of CDR Parameters

	ESUBD = ESUBM	Demand Elasicity	Number of Firms	Marginal Cost Markup	Average Cost Markup	CDR	Accepted CDR
1 GAS	10.4	2.899	1	1.527	1.233	**0.192**	0.192
2 OIL	10.4	3.998	5	1.053	1.147	**-0.090**	0.020
3 FMET	6.74	3.824	12	1.022	1.036	**-0.013**	0.020
4 NFM	8.4	6.385	12	1.013	1.114	**-0.099**	0.020
5 MVH	5.6	1.668	3	1.250	1.047	**0.162**	0.162

Appendix B.

Aggergation Scheme by Regions

##	Code	Description	GTAP Regions Included
1	RUS	Russian Federation	RUS
2	XSU	Former Soviet Union	XSU
3	EE	Eastern Europe	ALB, BGR, HRV, CZE, HUN, POL, ROM, SVK, SVN, EST, LVA, LTU
4	WE	Western Europe	AUT, BEL, DNK, FIN, FRA, DEU, GBR, GRC, IRL, ITA, LUX, NLD,PRT, ESP, SWE, CHE, XEF, CYP, MLT, TUR
5	NAFTA	NAFTA	USA, CAN, NEX
6	CHINA	China	CHN
7	ASA	Asia and Australia	AUS, NZL, HKG, JPN, KOR, TWN, IND, IDN, MYS, PHL, SGP, THA, VNM, BGD, LKA, XSA
8	SAM	South America	XCM, COL, PER, VEN, XAP, ARG, BRA, CHL, URY, RSM
9	AFR	Africa	MAR, XNF, DWA, XSC, MWI, MOZ, TZA, ZMB, ZWE, XSF, UGA, XSS
10	ROW	Rest of the World	XME, XRW

Appendix B.

Aggergation Scheme by Sectors

##	Code	Description	GTAP Sectors Included
1	GROW		WHT, GRO
2	AGP	Agriculture, plant products	PDR, V_F, OSD, C_B,PFB, OCR
3	AGA	Agriculture, animal products	CTL, OAP, RMK, WOL
4	FRFS	Forestry-Fishing	FOR, FSH
5	GAS	Natural gas	GAS
6	OIL	Oil	OIL
7	MEAT	Meat	CMT, OMT
8	DP	Dairy Products	MIL
9	OFP	Other Food Products	VOL, PCR, SGR, OFD, B_T
10	LIN	Light industry products	TEX, WAP, LEA, LUM, PPP
11	CEM	Chemical products	P_C, CRP,
12	FMET	Ferrous Metals and metal products	I_S, FMP
13	NFM	Nonferrous Metals	NFM
14	OMN	Other minerals	COL, OMN, NMM
15	MVH	Motor Vehicles	MVH
16	MNF	Manufactures	OTN, ELE, OME, OMF
17	ELY	Electricity	ELY
18	UTY	Other Utilities	GDT, WTR
19	CNS	Construction	CNS
20	TRD	Trade	TRD
21	OTR	Other Transport	OTP
22	ATP	Air Transport	ATP
23	WTP	Water Transport	WTP
24	CMM	Communications	CMN
25	BFS	Business and financial services	OFI, ISR, OBS
26	OSG	Public Administration, Defense, Education, Health, Recreational and other services	OSG, ROS
27	DWE	Dwellings	DWE

Appendix B.

Classification of goods

	Intermediate Usage	Final consumption	Export	Total
Export Oriented Sectors				
Nonferrous Metals	32%	0%	68%	100%
Natural Gas	50%	7%	42%	100%
Oil	59%	0%	41%	100%
Ferrous Metals and Metal Products	62%	1%	37%	100%
Chemical Products	64%	9%	27%	100%
Intermediate Goods				
Construction	97%	3%	0%	100%
Other Minerals	88%	4%	8%	100%
Trade	88%	11%	1%	100%
Electricity	82%	17%	1%	100%
Other Utilities	80%	18%	1%	100%
Final Consumption Goods				
Manufactures	71%	11%	18%	100%
Public Administration, Defense, Education, Health, Recreational and other services	9%	90%	1%	100%
Meat	85%	15%	0%	100%
Dairy Products	54%	44%	2%	100%
Agriculture, Animal Pproducts	40%	59%	1%	100%
Other Food Products	39%	55%	6%	100%
Communications	52%	42%	6%	100%
Agriculture, Plant Products	57%	41%	1%	100%
Forestry-Fishing	52%	32%	16%	100%
Light Industry Products	58%	25%	16%	100%
Motor Vehicles	73%	25%	2%	100%
Business and Financial Services	75%	18%	7%	100%
Dwellings	0%	100%	0%	100%

Transportation

	Intermediate Usage	Final consumption	Transportation services	Export	Total
Air Transport	25%	48%	3%	24%	100%
Other Transport (Railroad)	64%	28%	2%	6%	100%
Water Transport	52%	7%	19%	22%	100%

Source: GTAP database